

The Quantum View of the World

Boston - oct. 1982

Introduction

1. In November 1979 Prof. D'Espagnat published an article in Scientific American with the title "The Quantum Theory and Reality". The sub-heading read as follows:
"He believes that the world is made up of objects whose existence is independent of human consciousness, but is in conflict with DM and such facts established by experiment".
- Created a furor among physicists well what are those experiments which enable us to do experimental metaphysics?
2. On 28th Aug. 1981 The Times carried a report headed "Random events overruled Einstein".
In what sense is this claim true?
3. Interaction of philosophical and scientific problems in the understanding of DM.
Bohm Ex $\xleftarrow{\text{Phil. Thesis}}$ $\xrightarrow{\text{Phys}}$
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4. Minimal instrumentalist (statistical) Interpretation of DM used by physicists. But Einstein, Schrödinger and Bohr sought to provide a 'conceptual understanding' of

New form

$$\begin{aligned} \gamma_n &= a_n b_n + a_n b_n' + a_n' b_n - a_n' b_n' \\ &= a_n (b_n + b_n') + b_n' (a_n - a_n') \end{aligned}$$

$$\text{so } \gamma_n = \pm 2.$$

$$\therefore \frac{1}{N} \sum_{n=1}^N \gamma_n = c(a, 0) + c(a, 2) + c(a' 0) - c(a' 2) \leq 2$$

where $c(a, 2) = \frac{1}{N} \sum_{n=1}^N a_n b_n$, etc

$c(a, 2)$ are correlation coefficient

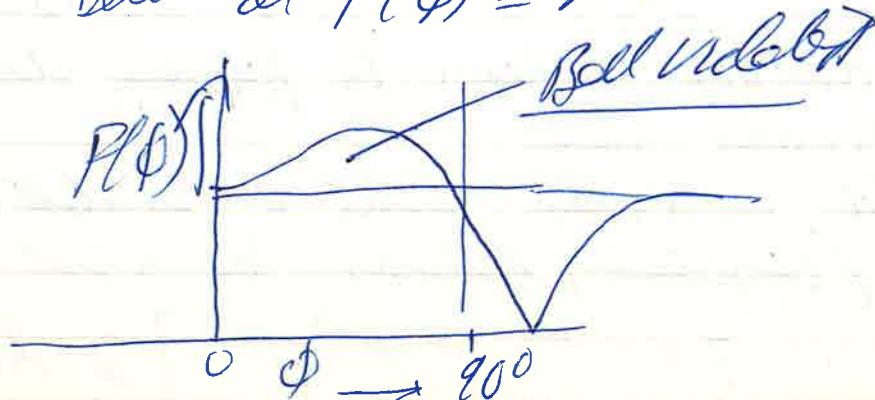
$\overline{a_n b_n}$ = covariance of random variables a_n, b_n

(V.R. Correlation Coeff. = $\frac{\text{Covariance}}{\sqrt{\text{Product of Variances}}}$
where covariances are cell property)

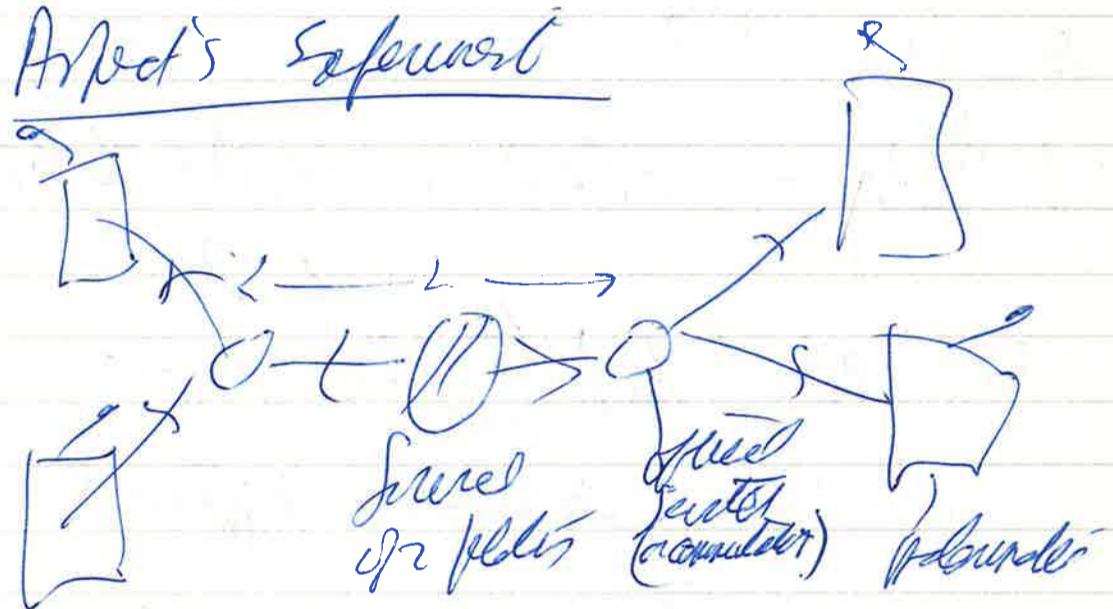
Then we have Bell inequality

It is violated by QM for appropriate choice of directions ϕ, ϕ', ϕ''
e.g. all direction coplanar

Write Bell or $F(\phi) \leq 2$



Arpelt's Experiment



Source of pulsed by a very high frequency acoustic wave standing wave induced a a crystal - wave of color or a variable diffraction grating. Modulation frequency of color 200 MHz.

$$L = 6 \text{ metres} \quad \frac{L}{c} = 2 \times 10^{-8} \text{ sec} \\ = 20 \times 10^{-9} \text{ sec} \\ = 20 \text{ nano seconds}$$

$$\text{frees frequency} \approx \frac{10^8}{2} \approx 50 \text{ billion gbs/sec} \\ \approx 50 \text{ MHz.}$$

N.B. Modulation of beam by frequency double that of acoustic wave. Sound is driven with a random deviator of its frequency between 200 to 250 MHz.

$$T = 0.5 \times 10^{-8} \text{ sec.} \quad \left. \begin{array}{l} \text{So stretch charge} \\ \text{in } \frac{1}{2} + \text{time of flight} \\ \text{of pulse for space to obtain} \end{array} \right\}$$

$$T = 10^{-8} \text{ sec.}$$